

# Embedded Intel® Architecture Reference Designs for Network Attached Storage



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## Executive Summary

The dramatic expansion of the Internet, pervasive networking, and the emergence of richer file types are all driving new demand for additional network data storage capability. Dedicated Network Attached Storage (NAS) appliances provide a simple and affordable storage solution for high-availability networks. There are a number of good reasons for the growing popularity of NAS devices:

- NAS appliances are easier to use and more cost-effective than dedicated PC-based file servers
- NAS solutions can support faster data access and higher network performance in workgroup networks
- Support for RAID (redundant array of independent disks) protects critical data and can also improve network performance
- NAS appliances are compact and transportable
- They enable network administrators to scale the storage capacity of a network without disrupting data availability.

The Intel® Entry-level and Value Communications Reference Designs provide fast time-to-market development solutions for dedicated single-purpose devices designed for file sharing/online storage. NAS appliances based on the Intel reference designs readily support RAID and other software-based, value-added functionality in a compact, low-cost appliance that provides scalable mass storage for today's high-availability networking environments.

## Intel® Communications Reference Designs

With their small (5.12" x 8.5") form-factor, the Intel Communications Reference Designs are ideal for compact and transportable NAS appliances. The design enables storage appliance vendors to meet the increasing storage requirements of growing networks, with the added benefit of software-based capabilities that can be upgraded directly over the network. Hardware components include the Intel® Celeron™ or Pentium® III processors in Socket 370 FC-PGA configuration, supported by either the Intel® 440BX or 810 chipsets. These components provide the processing and system-level performance headroom to meet the demands of present and future software applications. The Intel 440BX and 810 chipsets support a scalable design that enables developers to scale performance with higher-speed processors.

In addition to the processor and chipset, the platforms include two Intel® Ethernet controllers and Intel® Advanced Boot Block flash memory for non-volatile storage of BIOS and system firmware. The designs support four hard disk drives. The use of embedded Intel® Architecture provides a combination of component reliability, scalability and software compatibility that supports a variety of cost-effective NAS appliance applications. Intel's proof-of-concept platforms are available to board manufacturers and independent hardware vendors who are free to modify the designs to accommodate their specific application requirements.

## Making a Case for NAS

The traditional way to add storage capacity to a network is to add disk drives to servers or install a file server on the network. Both of these approaches are complex, and they can get in the way of data availability because the server must be off-line during the installation process. Compared to a PC-based file server, NAS appliances cost much less to buy and maintain. NAS appliances can be designed to enable simple plug and play installation with self-configuration, while the network remains up and running. In addition, adding more storage is as simple as plugging in another NAS appliance.

NAS appliances have a number of other advantages. They support cross-platform file sharing in heterogeneous network environments. Their versatile usage model includes file sharing, online storage, and data backup. In addition, the compact form factor of NAS appliances makes them a practical transportable storage solution.

Moreover, the installation of NAS appliances can improve network data flow. When they are used to cache frequently accessed files, NAS servers can remove potential bottlenecks from the network's general purpose server, especially when the network server must support large numbers of requests from multiple users. NAS appliances used for file caching can also be located in close proximity to the users who need the data. Implementing RAID Level 0, or data-striping across multiple disks, on the NAS can further improve data throughput.

# RAID Data Protection

Intel's reference designs for NAS provide support for an embedded operating system and enable RAID to be implemented in software. Supported RAID levels include:

- RAID Level 0, or data striping across multiple disks, without redundancy, for optimum performance.
- RAID Level 1, or disk mirroring, for ultimate data protection through full redundancy.
- RAID Level 5, data striping with parity, for a good combination of data protection and performance.

With the use of Celeron or Pentium III processors, Intel's reference designs provide the processing headroom to support RAID parity calculations, without requiring a dedicated RAID controller card. The hardware design also provides the built-in scalability to support future enhancements in software.

## Benefits for Developers

Intel's Communications Reference Designs provide numerous advantages for developers of NAS appliances:

- They provide a comprehensive platform solution that can dramatically accelerate time-to-market. Schematics are available for download at no cost from Intel's Developer Site:  
[developer.intel.com/platforms/applied/comm/index.htm](http://developer.intel.com/platforms/applied/comm/index.htm)
- The platforms are based on the open Intel Architecture that is familiar to most programmers. Moreover, the architecture supports multiple operating systems, including

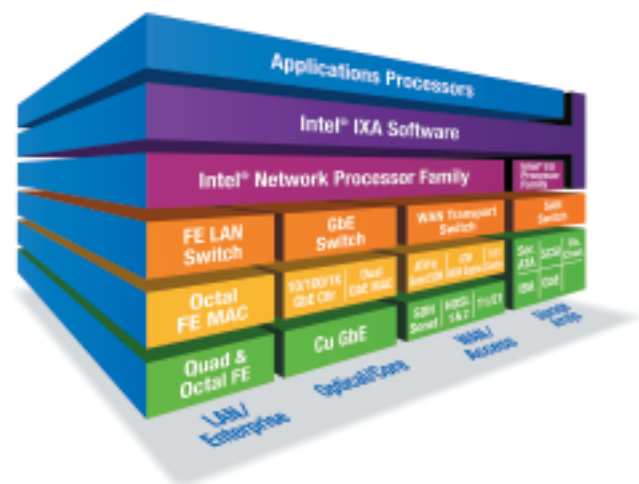
popular embedded operating systems.

- Scalable embedded Intel Architecture enables developers to differentiate their products by adding new value-added features and functionality, while maintaining the levels of performance that end-users expect.
- Intel processors and components provide the performance headroom to handle RAID and other processor-intensive software applications.
- Intel Architecture encompasses a large variety of development tools and software, including the components, tools and software available for the PC developers. Board-level solutions are supported by a variety of third-party vendors.
- The embedded Intel Architecture road map leads to higher levels of performance. Intel processors and other components are designed to meet the embedded lifecycle requirements of applied computing applications.
- Intel manufacturing capacity and quality helps ensure product reliability and customer satisfaction.

Intel® Internet  
Exchange™  
Architecture

The Intel® Internet Exchange™ architecture (IXA), as shown in Figure 1, provides a consistent framework for OEMs and independent software vendors to quickly deploy new networking and communications services and develop differentiated networking products that deliver scalable performance with reduced total cost of ownership. Intel IXA includes end-to-end development solutions and building blocks that enable developers to create solutions for the entire Open Systems Interconnectivity (OSI) stack.

Embedded Intel Architecture delivers solutions that meet the performance requirements of the Application Services Layer of the OSI Model. By incorporating scalable embedded Intel Architecture components and software within Intel IXA, Intel is delivering a flexible top-to-bottom architecture that delivers high performance, scalability, code compatibility and programmability that enables faster and more cost effective software-based product differentiation.



### Figure 1 Intel® Internet Exchange Architecture

## Conclusion: Embedded Intel Architecture Makes Sense for NAS

Network data storage requirements continue to grow, with no end in sight. Affordable and compact Network Attached Storage enables network users to scale storage capacity, while maintaining high data availability, with the data protection of RAID.

Intel's Communications Reference Designs provide fast time-to-market development solutions for reliable and easily upgradable NAS appliances. Intel's reference designs combine easy programmability with flexibility and performance headroom in a configuration designed to support fast time-to-market development by hardware and software vendors.

## For More Information

For more information on Intel's Communications Reference Designs, including block diagrams and downloadable schematics, visit Intel's Developer Site at:  
[developer.intel.com/platforms/applied/comm/index.htm](http://developer.intel.com/platforms/applied/comm/index.htm)

For more information on Intel Internet Exchange Architecture solutions, visit:  
[www.intel.com/ixa](http://www.intel.com/ixa)

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